

# JAPAN

## EDICT OF GOVERNMENT

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JIS S 0032 (2003) (English): Guidelines for the elderly and people with disabilities -- Visual signs and displays -- Estimation of minimum legible size for a Japanese single character

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*The citizens of a nation must  
honor the laws of the land.*

Fukuzawa Yukichi

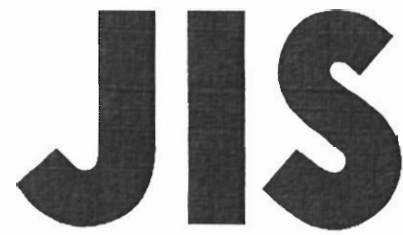
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STANDARD

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**JIS S 0032** : 2003

(AIST/NITE)

**Guidelines for the elderly and  
people with disabilities—  
Visual signs and displays—  
Estimation of minimum legible size  
for a Japanese single character**

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ICS 13.120; 37.080; 97.020

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## Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal of establishing a Japanese Industrial Standard from National Institute of Advanced Industrial Science and Technology (AIST)/National Institute of Technology and Evaluation, Conformity Assessment Center (NITE), with a draft of Industrial Standard based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

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## **Guidelines for the elderly and people with disabilities—Visual signs and displays— Estimation of minimum legible size for a Japanese single character**

**Introduction** Although character information is indispensable to the social life of the information technology (IT) age, since it is displayed and printed in various forms and sizes, characters which are hard to read for the elderly whose visual acuity is being reduced mainly because of aging are displayed in many cases. This Standard describes the method for estimating the minimum legible size for various characters quantitatively as a guideline for designing the characters used for visual signs and displays, such as signs, indicating labels, and pamphlets. It is expected that the establishment of this Standard will be the first step in realizing the environment where suitable characters which are easily legible for many people in everyday life are used.

**1 Scope** This Japanese Industrial Standard specifies the estimation method of minimum legible size for a single character of Japanese characters such as HIRAGANA characters, KATAKANA characters, Arabic numerals and Chinese characters which the target to be observed of any age from the young to the elderly (hereafter referred to as “the target”) can read under various environments. The target characters shall be of two typefaces, Ming type and Gothic type, which are displayed in a dark colour in a bright background with the high contrast such as a black design on a white background and shall be used for visual signs and displays, such as signs, indicating labels, and pamphlets. Characters displayed with a dot-type electronic display are excluded.

In addition, although the alphabet is not within the scope of this Standard, the estimation of minimum legible size for an alphabetical character may be done according to the specification for HIRAGANA characters, KATAKANA characters, Arabic numerals.

- Remarks
- 1 In this Standard, the target shall be in any age between 10 years old and 80 years old, and the minimum legible size for a character, which the healthy target without a visual medical history can read by the percentage of correct answers of 80 %, can be estimated.
  - 2 In this Standard, the minimum legible size for a character, which can be read by the target whose vision is corrected to have the maximum visual acuity at a viewing distance of 5 m, can be estimated. This Standard does not apply in the case of the vision correction performed at a viewing distance other than 5 m. For example, in the case of the vision correction performed at a viewing distance shorter than 5 m, even a character of smaller character size than that estimated in this Standard will be legible.
  - 3 As the information in this Standard, *Method for evaluation of legibility of Japanese text* is given in Annex 1 (informative), and *Dimensions of the Japanese character size and their example* is given in Annex 2 (informative).

**2 Normative references** The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) shall be applied.

JIS T 7309 *Visual acuity testing equipment*

JIS Z 8113 *Lighting vocabulary*

JIS Z 8305 *Dimensions of printing types*

**3 Definitions** For the purposes of this Standard, the definitions given in **JIS Z 8113** and the following definitions apply.

- a) **visual acuity** A reciprocal of angle (minute) from the target to the minimum width such that the break of the Landolt-ring sign is able to be distinguished using the Landolt-ring sign specified in **JIS T 7309**.
- b) **landolt ring** A sign used for the measurement of visual acuity when using the visual acuity testing equipment specified in **JIS T 7309**.
- c) **viewing distance** A distance (expressed in m) between the eye of the target and the object to look at.
- d) **luminance correction coefficient** The coefficient for correcting the effects of luminance on visual acuity on the basis of 100 cd/m<sup>2</sup>.
- e) **character size** A size (expressed in point) of the character specified in **JIS Z 8305**.
- f) **size coefficient** Quantity defined by  $D/V$  using visual acuity  $V$  at a viewing distance of  $D$  (m). It corresponds to the minimum resolution of vision under the relevant observation conditions.
- g) **minimum legible character size** The minimum character size (expressed in point) for a single character of Japanese characters such as HIRAGANA characters, KATAKANA characters, Arabic numerals and Chinese characters which can be read under the relevant observation condition by the percentage of correct answers of not less than 80 %.

**4 Observation conditions** The observation conditions shall be as follows, and the minimum legible character size of a Japanese character in the respective ranges shall be estimated.

- a) **Age of the target** The age of the target shall be from 10 years old to 80 years old.
- b) **Viewing distance** The viewing distance shall be from 0.2 m to 100 m.
- c) **Luminance** The luminance shall be 0.01 cd/m<sup>2</sup> to 3 000 cd/m<sup>2</sup>. The luminance here refers to the luminance of background, and not characters.

**5 Estimation of minimum legible character size for a Japanese character** The minimum legible character size for a Japanese character shall be estimated according to the following procedure.

- a) Obtain vision acuity  $V_0$  in luminance of 100 cd/m<sup>2</sup> according to the age of the target and viewing distance from Attached Table 1.



- b) Obtain luminance correction coefficient  $k$  corresponding to luminance  $L$  (cd/m<sup>2</sup>) under the observation conditions using Attached Table 2, and correct vision acuity  $V_0$  obtained in a) according to the formula (1).

$$V = kV_0 \quad \text{..... (1)}$$

where,  $V$ : vision acuity under observation conditions  
 $k$ : luminance correction coefficient  
 $V_0$ : vision acuity in luminance of 100 cd/m<sup>2</sup> according to the age of the target and viewing distance

- c) Calculate size coefficient  $S$  according to the formula (2).

$$S = \frac{D}{V} \quad \text{..... (2)}$$

where,  $S$ : size coefficient  
 $D$ : viewing distance (m)  
 $V$ : vision acuity under observation conditions

- d) Calculate the minimum legible character size for a Japanese character  $P_{\min}$  (point) using size coefficient and the coefficient given in Table 1 according to the formula (3).

$$P_{\min} = aS + b \quad \text{..... (3)}$$

where,  $P_{\min}$ : minimum legible character size (point)  
 $a$ : coefficient given in Table 1  
 $S$ : size coefficient  
 $b$ : coefficient given in Table 1

**Table 1 Coefficient of formula according to which minimum legible character size for a Japanese character is calculated**

Classification of Japanese character		$a$	$b$
Ming type	HIRAGANA character	8.2	2.6
	KATAKANA character		
	Arabic numerals		
	Chinese character 5 strokes to 10 strokes	9.6	2.8
	Chinese character 11 strokes to 15 strokes	9.6	3.6
Gothic type	HIRAGANA character	6.4	3.0
	KATAKANA character		
	Arabic numerals		
	Chinese character 5 strokes to 10 strokes	8.1	3.4
	Chinese character 11 strokes to 15 strokes	8.6	4.1

Remarks : When there are no applicable conditions in Attached Table 1 and Attached Table 2, for Attached Table 1, the applicable value shall be calculated by the interpolation which divides the age of the target internally and linearly, and for Attached Table 2, the applicable value shall be calculated by the interpolation which divides the logarithm of distance internally and linearly.

Information : The alphabet may be used based on the reference to the values (in the table) of HIRAGANA characters, KATAKANA characters, and Arabic numerals, and Chinese characters from 1 stroke to 4 strokes, referring to the values of Chinese characters from 5 strokes to 10 strokes, and Chinese characters of 16 strokes or over, referring to the values of Chinese characters from 11 strokes to 15 strokes.

**6 Record** When estimating the minimum legible character size for a Japanese character, the following items should be recorded as appropriate.

a) Age of the target

Example: 68 years old

b) Observation conditions

Example: Viewing distance 0.5 m, luminance 10 cd/m<sup>2</sup>

c) Estimated result

Example: Gothic type Chinese character 8 strokes 17.3 points

**7 Precautions on dealing with estimation result of minimum legible character size** The character size estimated in accordance with this Standard is derived for the healthy people without a visual medical history, and it may be unsuitable for those who have a failure in vision, such as those with an eye disease, and those with a weak eyesight. Therefore, when designing the character size, care shall be taken so that the character size is made larger than the estimation result according to the usage, etc.

**Attached Table 1 Visual acuity ( $V_0$ ) in luminance of 100 cd/m<sup>2</sup> according to age of the target (\*) and viewing distance**

Age (years)	Viewing distance (m)											
	0.2	0.3	0.5	1	2	3	5	10	20	30	50	100
10	1.237 4	1.410 9	1.567 1	1.695 5	1.763 6	1.786 9	1.805 8	1.791 9	1.784 9	1.782 5	1.780 7	1.779 3
12	1.124 6	1.316 4	1.493 2	1.641 2	1.720 6	1.747 9	1.770 1	1.753 8	1.745 5	1.742 8	1.740 6	1.739 0
14	1.022 1	1.228 3	1.422 8	1.588 6	1.678 6	1.709 8	1.735 1	1.716 5	1.707 1	1.703 9	1.701 4	1.699 6
16	0.929 0	1.146 0	1.355 7	1.537 7	1.637 7	1.672 5	1.700 8	1.680 0	1.669 5	1.666 0	1.663 2	1.661 1
18	0.844 3	1.069 3	1.291 8	1.488 5	1.597 8	1.636 0	1.667 2	1.644 3	1.632 7	1.628 8	1.625 7	1.623 4
20	0.767 4	0.997 7	1.230 8	1.440 8	1.558 8	1.600 3	1.634 3	1.609 3	1.596 7	1.592 5	1.589 2	1.586 7
22	0.697 4	0.930 9	1.172 8	1.394 6	1.520 8	1.565 4	1.602 0	1.575 1	1.561 5	1.557 0	1.553 4	1.550 7
24	0.633 9	0.868 6	1.117 5	1.350 0	1.483 7	1.531 2	1.570 3	1.541 6	1.527 1	1.522 3	1.518 5	1.515 6
26	0.576 1	0.810 4	1.064 8	1.306 7	1.447 6	1.497 8	1.539 3	1.508 8	1.493 4	1.488 3	1.484 3	1.481 3
28	0.523 6	0.756 1	1.014 6	1.264 9	1.412 3	1.465 1	1.508 9	1.476 7	1.460 5	1.455 2	1.450 9	1.447 7
30	0.475 9	0.705 5	0.966 7	1.224 3	1.377 8	1.433 2	1.479 0	1.445 3	1.428 3	1.422 7	1.418 2	1.414 9
32	0.432 5	0.658 3	0.921 1	1.185 1	1.344 2	1.401 9	1.449 8	1.414 6	1.396 9	1.391 0	1.386 3	1.382 8
34	0.393 1	0.614 2	0.877 7	1.147 1	1.311 5	1.371 3	1.421 2	1.384 5	1.366 1	1.360 0	1.355 1	1.351 5
36	0.357 3	0.573 1	0.836 3	1.110 4	1.279 5	1.341 4	1.393 1	1.355 0	1.336 0	1.329 7	1.324 7	1.320 9
38	0.324 7	0.534 7	0.796 9	1.074 8	1.248 3	1.312 1	1.365 6	1.326 2	1.306 5	1.300 0	1.294 8	1.291 0
40	0.295 1	0.498 9	0.759 3	1.040 4	1.217 9	1.283 5	1.338 6	1.298 0	1.277 7	1.271 0	1.265 7	1.261 7
42	0.268 2	0.465 5	0.723 5	1.007 1	1.188 2	1.255 5	1.312 1	1.270 4	1.249 6	1.242 7	1.237 2	1.233 2
44	0.243 8	0.434 3	0.689 4	0.974 8	1.159 2	1.228 1	1.286 2	1.243 4	1.222 0	1.215 0	1.209 4	1.205 2
46	0.221 6	0.405 2	0.656 8	0.943 6	1.130 9	1.201 3	1.260 8	1.216 9	1.195 1	1.187 9	1.182 2	1.177 9
48	0.201 4	0.378 1	0.625 9	0.913 4	1.103 4	1.175 1	1.235 9	1.191 1	1.168 8	1.161 4	1.155 6	1.151 2
50	0.183 0	0.352 8	0.596 3	0.884 1	1.076 5	1.149 5	1.211 4	1.165 7	1.143 0	1.135 5	1.129 6	1.125 1
52	0.166 3	0.329 2	0.568 2	0.855 8	1.050 2	1.124 4	1.187 5	1.140 9	1.117 8	1.110 2	1.104 2	1.099 7
54	0.151 2	0.307 1	0.541 4	0.828 4	1.024 6	1.099 9	1.164 0	1.116 7	1.093 2	1.085 5	1.079 3	1.074 7
56	0.137 4	0.286 5	0.515 9	0.801 8	0.999 6	1.075 9	1.141 0	1.092 9	1.069 1	1.061 3	1.055 0	1.050 4
58	0.124 9	0.267 4	0.491 6	0.776 1	0.975 3	1.052 4	1.118 5	1.069 7	1.045 5	1.037 6	1.031 3	1.026 6
60	0.113 5	0.249 5	0.468 4	0.751 3	0.951 5	1.029 4	1.096 4	1.046 9	1.022 5	1.014 5	1.008 1	1.003 3
62	0.103 2	0.232 8	0.446 3	0.727 2	0.928 3	1.007 0	1.074 7	1.024 7	1.000 0	0.991 9	0.985 4	0.980 6
64	0.093 8	0.217 2	0.425 2	0.703 9	0.905 6	0.985 0	1.053 5	1.002 9	0.977 9	0.969 7	0.963 2	0.958 4
66	0.085 2	0.202 6	0.405 2	0.681 4	0.883 6	0.963 5	1.032 7	0.981 5	0.956 4	0.948 1	0.941 6	0.936 7
68	0.077 4	0.189 1	0.386 1	0.659 5	0.862 0	0.942 5	1.012 3	0.960 7	0.935 3	0.927 0	0.920 4	0.915 5
70	0.070 4	0.176 4	0.367 9	0.638 4	0.841 0	0.921 9	0.992 2	0.940 2	0.914 7	0.906 3	0.899 7	0.894 7
72	0.064 0	0.164 6	0.350 5	0.618 0	0.820 5	0.901 8	0.972 6	0.920 2	0.894 5	0.886 1	0.879 4	0.874 5
74	0.058 1	0.153 6	0.334 0	0.598 2	0.800 5	0.882 1	0.953 4	0.900 7	0.874 8	0.866 4	0.859 6	0.854 7
76	0.052 8	0.143 3	0.318 2	0.579 0	0.781 0	0.862 9	0.934 6	0.881 5	0.855 5	0.847 0	0.840 3	0.835 3
78	0.048 0	0.133 7	0.303 2	0.560 5	0.761 9	0.844 1	0.916 1	0.862 8	0.836 7	0.828 2	0.821 4	0.816 4
80	0.043 7	0.124 7	0.288 9	0.542 5	0.743 4	0.825 7	0.898 0	0.844 4	0.818 2	0.809 7	0.802 9	0.797 9

Note \* The target here refers to the healthy person without a visual medical history.

**Attached Table 2 Luminance correction coefficient (*k*)**

Luminance (cd/m <sup>2</sup> )	Luminance correction coefficient
0.01	0.028 0
0.02	0.101 2
0.03	0.143 9
0.04	0.174 3
0.05	0.197 8
0.06	0.217 1
0.07	0.233 4
0.08	0.247 5
0.09	0.259 9
0.1	0.271 0
0.2	0.344 2
0.3	0.386 9
0.4	0.417 3
0.5	0.440 8
0.6	0.460 1
0.7	0.476 4
0.8	0.490 5
0.9	0.502 9
1	0.514 0
2	0.587 2
3	0.629 9
4	0.660 3
5	0.683 8
6	0.703 1
7	0.719 4
8	0.733 5
9	0.745 9
10	0.757 0
20	0.830 2
30	0.872 9
40	0.903 3
50	0.926 8
60	0.946 1
70	0.962 4
80	0.976 5
90	0.988 9
100	1.000 0

Luminance (cd/m <sup>2</sup> )	Luminance correction coefficient
100	1.000 0
200	1.035 8
300	1.056 8
400	1.071 6
500	1.083 2
600	1.092 6
700	1.100 6
800	1.107 5
900	1.113 6
1 000	1.119 0
2 000	1.154 8
3 000	1.175 8

## Annex 1 (informative)

### Method for evaluation of legibility of Japanese text

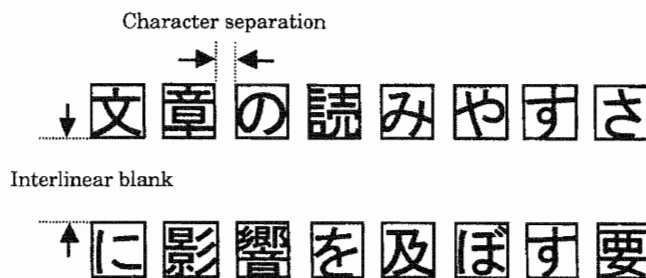
This Annex (informative) describes the complementary matter related to the body of this Standard, and does not constitute provisions of this Standard.

**Introduction** This Annex describes the method for evaluating the legibility of Japanese text under various observation conditions.

**1 Scope** This Annex is applied when evaluating the visual legibility of Japanese text including HIRAGANA characters, KATAKANA characters, Arabic numerals, and Chinese characters. This Annex is not used for evaluating the comprehensibility of meaning and intelligibility of Japanese text. Japanese text here refers to the text which consists of various character sizes, character separation and interlinear blank for the common visual signs and displays excluding the dot-type electronic display. It is desirable that the number of characters in one line is 5 or over, and the number of lines is 3 lines or over.

**2 Definitions** For the purpose of this Standard, in addition to the definitions in clause 3 of the body of this Standard and **JIS Z 8113**, the following definitions shall apply.

- a) **relative character size** A character size (expressed in point) corrected by dividing the character size by size coefficient  $S$ .
- b) **character separation** A gap between two adjoining characters in the text of a certain character size. The magnitude of one character is expressed as a unit (see Annex 1 Fig. 1).



**Annex 1 Fig. 1 Definitions of character separation and interlinear blank**

- c) **interlinear blank** A gap between two adjoining lines in the text of a certain character size. The magnitude of one character is expressed as a unit (see Annex 1 Fig. 1).
- d) **legibility** Visual legibility of the text judged based on conspicuousness, ease to discriminate, etc.

- e) **legibility evaluation value** A value scaled with six steps from 0 to 5 subjectively, which correspond to the degree of legibility from “not able to read at all” to “very easy to read”.

### 3 Method for evaluation of legibility of Japanese text

**3.1 Calculation of evaluation value** The evaluation value of legibility of Japanese text shall be calculated according to the following procedure.

- a) Calculate the size coefficient  $S$  under observation conditions according to the formula specified in clause 5 of the body of this Standard from the target ( $A$  years old) and observation conditions (viewing distance  $D$  m, luminance  $L$  cd/m<sup>2</sup>).
- b) Calculate relative character size  $P_s$  (point) according to the formula (1) from character size  $P$  (point) and the size coefficient  $S$  which constitutes a text.

$$P_s = \frac{P}{S} \dots\dots\dots (1)$$

where,  $P_s$  : relative character size (point)  
 $P$  : character size (point)  
 $S$  : size coefficient

- c) Calculate the legibility evaluation value  $R_s$  for character size according to the formula (2).

$$\left[ \begin{array}{ll} R_s = 0 & (0 \leq P_s < 4) \\ R_s = 6 \log (P_s) - 3.7 & (4 \leq P_s \leq 30) \\ R_s = 5 & (30 < P_s) \end{array} \right] \dots\dots\dots (2)$$

where,  $R_s$  : legibility evaluation value for character size  
 $P_s$  : relative character size (point)

- d) Calculate the legibility evaluation value  $R_c$  for character separation according to the formula (3).

$$R_c = -0.175 \frac{C}{P_s} \dots\dots\dots (3)$$

where,  $R_c$  : legibility evaluation value for character separation  
 $P_s$  : relative character size (point)  
 $C$  : character separation

- e) Calculate the legibility evaluation value  $R_N$  for interlinear blank according to the formula (4).

$$R_N = 0.844N^{(-0.012P_s+0.33)} \dots\dots\dots (4)$$

where,  $R_N$  : legibility evaluation value for interlinear blank  
 $P_s$  : relative character size (point)  
 $N$  : interlinear blank

- f) Calculate the total legibility evaluation value  $R$  by integrating the effects of character size, character separation, and interlinear blank according to the formula (5).

$$R = R_S + R_C + R_N \quad \text{..... (5)}$$

where,  $R$  : total legibility evaluation value

$R_S$  : legibility evaluation value for character size

$R_C$  : legibility evaluation value for character separation

$R_N$  : legibility evaluation value for interlinear blank

**3.2 Classification and evaluation of legibility evaluation value** Perform the classification and evaluation of legibility evaluation value calculated in the formula (5) in accordance with Annex 1 Table 1.

**Annex 1 Table 1 Classification of legibility**

Evaluation value	Legibility evaluation
4.5 or over up to and incl. 5	Very easy to read
3.5 or over to and excl. 4.5	Slightly easy to read
2.5 or over to and excl. 3.5	Medial
1.5 or over to and excl. 2.5	Slightly hard to read
0.5 or over to and excl. 1.5	Very hard to read
0 or over to and excl. 0.5	Not able to read

## Annex 2 (informative)

### Dimensions of Japanese character size and their example

This Annex (informative) describes the complementary matter related to the body of this Standard, and does not constitute provisions of this Standard.

**1 Scope** This Annex describes the dimensions of the Japanese character size in accordance with **JIS Z 8305** and shows the example of actual dimensions.

**2 Dimensions of the Japanese character size and their example** The dimensions of Japanese character size (point) are given in Annex 2 Table 1 and the example of actual dimensions is shown in Annex 2 Fig. 1.

**Annex 2 Table 1 Dimensions of character size (point)**

Point	mm conversion
3	1.054
5	1.757
7	2.460
8	2.811
9	3.163
10	3.514
12	4.217
14	4.920
16	5.622
18	6.325
20	7.028
24	8.434
28	9.839
36	12.650
48	16.867
72	25.301

Character size	Ming type	Gothic type
3 points	標	標
7 points	標	標
10 points	標	標
14 points	標	標
18 points	標	標
24 points	標	標
36 points	標	標
48 points	標	標
72 points	標	標

**Annex 2 Fig. 1 Example of actual dimensions of character size (point)**



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